



Carbohydrate – how much?

Carbohydrate is a critical fuel source for the muscle and central nervous system. The availability of carbohydrate plays a key role in the performance of exercise lasting an hour or more. Therefore, sports nutrition guidelines promote carbohydrate intake before, during and after exercise to meet the fuel requirements of the activity.

Carbohydrate intakes - should they be described as percentages or grams?

Nutrition guidelines for the community express goals for carbohydrate intake in terms of the percentage of total energy they should provide - for example 55% of energy intake should come from carbohydrate. This general guideline is appropriate when muscle fuel needs are moderate - for example, for people who are undertaking less than an hour of exercise each day, or doing exercise that is of low intensity.

However, in situations where maximal glycogen storage is desirable or the athlete must meet the fuel bill of prolonged exercise sessions, carbohydrate needs are higher and more specific. Studies have determined the absolute requirement of the muscle for carbohydrate in these situations (see Table 1). However, some sports nutritionists have continued to describe the increased needs for carbohydrate in terms of energy ratios - for example, an endurance athlete should eat 70% of energy from carbohydrate.

In these specific situations it is best to set definite carbohydrate intake goals for athletes, scaled to their body size and therefore, their muscle mass. A guideline to consume 7-10 g of carbohydrate per kilogram body mass (BM) is not only tailored to the muscle's needs, but is more "user-friendly" for the athlete. An athlete can calculate a definite carbohydrate target in grams, and use food tables or information on food labels to plan meals to reach this goal. Even better, an athlete can see a sports dietitian for advice to further narrow this target range according to his/her specific situation, and have an individualised meal plan fitted to their needs.

Table 1

Situation	Recommended Carbohydrate Intake
Daily refuelling needs for training programs less than 60-90 min per day or low intensity exercise	Daily intake of 5-7 g per kg BM
Daily refuelling for training programs greater than 90-120 min per day	Daily intake of 7-10 g per kg BM
Daily refuelling for athletes undertaking extreme exercise program - 6-8 hours per day (cycling tour)	Daily intake of 10-12+ g per kg BM
Carbohydrate loading for endurance and ultra-endurance events	Daily intake of 7-10 g per kg BM
Pre-event meal	Meal eaten 1-4 hours pre-competition 1-4 g per kg BM
Carbohydrate intake during training sessions and competition events greater than 1 hour	1 g per min or 60 g per hour
Rapid recovery after training session or multi-day competition, especially when there is less than 8 h until next session	Intake of 1 g per kg BM in the first 30 min after exercise, repeated every 1-2 hours until regular meal patterns are resumed





Why is it confusing to continue to use % energy targets for athletes with high-energy needs?

The amount of carbohydrate needed to fuel the gruelling training or competition schedules of many athletes is higher than the typical carbohydrate intakes of most people. And it may require an athlete to devote more of their total energy intake to 'fuel foods' to do so. Typically, it might require the athlete to earmark 60-70% of their energy intake for carbohydrate needs. However, in practice the total energy needs and the muscle fuel needs of an athlete are not always synchronised, so this energy ratio is not fixed. Some large athletes have very high energy requirements to cover the cost of growth as well as their training. For these athletes, total intakes of 800-1000 g of carbohydrate representing 8-10 grams per kilogram BM may be consumed from only 45% of their energy budget. On the other hand, athletes who are restricting their energy intake to stay lean may need to devote 70% of their energy budget to achieve a carbohydrate intake of even 6-7 grams per kilogram. Therefore, it is difficult and confusing to give carbohydrate intake guidelines on the basis of an energy ratio alone. It is not certain that this will guarantee the absolute amount of carbohydrate that the muscle needs.

Can you tell if an athlete is fuelling up well enough if they are eating more than 50% of their energy from carbohydrate?

Some people judge the fuel intake of an athlete to be 'deficient' or 'inadequate' based on the percentage of energy derived from carbohydrate. However, as in the situation described above, an athlete might be consuming a large intake of carbohydrate in grams, adequate in terms of their fuel requirements, but be judged to be following an inadequate carbohydrate intake from the perspective of energy ratio. On the other hand an athlete might be eating a very high proportion of his/her limited energy intake from carbohydrate foods, and still only eat a small number of grams of carbohydrate. So, percentage figures are not a good guide.

And although total amounts of carbohydrate in grams may be a better guide, they still must be regarded with some flexibility. In all areas of nutrition, judgments of adequacy or deficiency cannot be made from a single piece of evidence. This is particularly the case when the evidence comes from a food record or another type of self-reported dietary assessment. Athletes, just like sedentary people, are not necessarily accurate in describing their real food intake - and most often they underestimate or under-reported their true intake of food and nutrients.

Dietary assessments should be done by an expert such as a sports dietitian, who will work with an individual athlete to collect different sources of information related to their nutritional needs and eating patterns. Specific information about the athlete's training load and their ability to recover between sessions may help to fine-tune carbohydrate intake targets. It is important, particularly in terms of judging everyday carbohydrate intake, to regard guidelines as an approximation rather than a fixed rule. Generally, though, for athletes who have an important or increased need for carbohydrate needs, it is more reliable and practical to set guidelines in terms of a fixed amount of carbohydrate, rather than an energy percentage.

How can I check the amount of carbohydrate I eat each day?

The following chart provides information about the carbohydrate content of common foods. Each food portion provides 50 g of carbohydrate. Use this information to plan a daily menu, or specific pre-event meals and post-exercise recovery meals to meet the carbohydrate intake targets provided in Table 1. These carbohydrate-rich foods should form the basis of meals and snacks, with other nutrient-rich foods added to round out the meal.





Food Portions Providing 50 g of Carbohydrate

CEREAL

Wheat biscuit cereal (e.g. Weet Bix)	60g (5 biscuits)
'Light' breakfast cereal (e.g. Cornflakes)	60 g (2 cups)
'Muesli' flake breakfast cereal	65 g (1-1.5 cups)
Toasted muesli	90 g (1 cup)
Porridge - made with milk	350 g (1.3 cups)
Porridge - made with water	550 g (2.5 cups)
Rollled oats	90 g (1 cup)

Bread	110 g (4 slices white or 3 thick wholegrain)
Bread rolls	110 g (1 large or 2 medium)
Pita and lebanese bread	100 g (2 pita)
Chapati	150 g (2.5)
English muffin	120 g (2 full muffins)
Crumpet	2.5

Muesli bar	2.5
Rice cakes	6 thick or 10 thin
Crispbreads and dry biscuits	6 large or 15 small
Fruit filled biscuits	5
Plain sweet biscuits	8-10
Cream filled/chocolate biscuits	6
Cakestyle muffin	115 g (1 large or 2 medium)
Pancakes	150 g (2 medium)
Scones	125 g (3 medium)
Iced fruit bun	105 g (1.5)
Croissant	149 g (1.5 large or 2 medium)

Rice, boiled	180g (1 cup)
Pasta or noodles, boiled	200 g (1.3 cups)
Canned spaghetti	440 g (large can)

FRUIT

Fruit crumble	1 cup
Fruit packed in heavy syrup	280 g (1.3 cups)
Fruit stewed/canned in light syrup	520 g (2 cups)
Fresh fruit salad	500 g (2.5 cups)
Bananas	2 medium-large
Large fruit (mango, pear, grapefruit etc.)	2-3
Medium fruit (orange, apple etc.)	3-4
Small fruit (nectarine, apricot etc.)	12
Grapes	350 g (2 cups)
Melon	1,000 g (6 cups)
Strawberries	1,800 g (12 cups)
Sultanas and raisins	70 g (4 Tbsp)
Dried apricots	115 g (22 halves)

FACT SHEET





FACT SHEET

VEGETABLES

Potatoes	350 g (1 very large or 3 medium)
Sweet potato	350 g (2.5 cups)
Corn	300 g (1.2 cups creamed corn or 2 cobs)
Green Beans	1,800 g (14 cups)
Baked beans	440 g (1 large can)
Lentils	400 g (2 cups)
Soy beans and kidney beans	400 g (2 cups)
Tomato puree	1 litre (4 cups)
Pumpkin and peas	700 g (5 cups)

DAIRY PRODUCTS

Milk	1 litre
Flavoured milk	560 ml
Custard	300 g (1.3 cup or half 600 g carton)
'Diet' yoghurt and natural yoghurt	800 g (4 individual tubs)
Flavoured non-fat yoghurt	350 g (2 individual tubs)
Icecream	250 g (10 Tbsp)
Fromage frais	400 g (2 tubs)
Rice pudding/creamed rice	300 g (1.5 cups)

SUGARS and CONFECTIONERY

Sugar	50 g
Jam	3 Tbsp
Syrups	4 Tbsp
Honey	3 Tbsp
Chocolate	80 g
Mars Bar and other 50-60 g bars	1.5 bars
Jubes and jelly babies	60 g

MIXED DISHES

Pizza	200 g (medium -1/4 thick or 1/3 thin)
Hamburgers	1.3 Big Macs
Lasagne	400 g serve
Fried rice	200 g (1.3 cups)

DRINKS

Fruit juice - unsweetened	600 ml
Fruit juice - sweetened	500 ml
Cordial	800 ml
Soft drinks and flavored mineral water	500 ml
Fruit smoothie	250-300 ml

SPORTS FOODS

Sports drink	700 ml
Carbohydrate loader supplement	250 ml
Liquid meal supplement	250-300 ml
Sports bar	1-1.5 bars
Sports gels	2 sachets
Glucose polymer powder	60 g

(from Peak Performance: training and nutritional strategies for sport J. Hawley and L. Burke. Sydney: Allen & Unwin, 1998.)